



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Tso

Serial No. 10/036,703

Filed: December 31, 2001

For: A METHOD OF PROXY-ASSISTED  
PREDICTIVE PRE-FETCHING

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) Examiner: Winder, Patrice L  
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) Art Unit: 2145  
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Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

DECLARATION PURSUANT TO 37 C.F.R. § 1.131

Madam:

I, Michael Tso, hereby declare that:

1. I am the inventor of the above-captioned patent application and the subject matter described and claimed therein.
2. Intel Corporation of Santa Clara, California, is the assignee of the above-captioned patent application.
3. I was employed by Intel Corporation at the time the above-captioned patent application was conceived.
4. Prior to December 10, 1997 I conceived of the invention according to each of independent claims 1, 29, and 34 of the above-captioned patent application in this country, as evidenced by Exhibit A (dates in redacted form).
5. Exhibit A is a copy of an Intel invention disclosure that Jin Jing and Michael Tso prepared and submitted to an Intel patent review committee prior to December 10, 1997. The invention disclosure concerns subject matter disclosed in the above-captioned patent application.

42390P4474D  
Serial No. 10/036,703

Examiner: Winder, Patrice L  
Art Unit: 2145

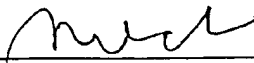
6. The subject matter disclosed and claimed in the above-captioned patent application was implemented in a proxy server codenamed the "Scappoose" proxy server, as indicated in Exhibit A. The invention was reduced to practice and used in this country in a product marketed as "Intel Quick Web Technology" prior to December 10, 1997.

7. Exhibit B is a press release dated September 25, 1997 from Intel Corporation describing the beta version release of Intel's Quick Web Technology in which the subject matter of independent claims 1, 29, and 34 was implemented. The press release describes industry reaction to the release of the Intel Quick Web Technology.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the above-captioned application or any patent issued thereon.

Respectfully submitted,

Date 4/20, 2006

  
Michael Tso

60243

ICG (MHPG/MCO)

## INTEL INVENTION DISCLOSURE

LEGAL ID# 60243 DATE: \_\_\_Invented

Disclosure written

It is important to provide accurate and detailed information on this form. The information will be used to evaluate your invention for possible filing as a patent application. When completed, please return this form to the Legal Department at RN4-01. If you have any questions regarding this form or to whom it should be forwarded, please call 765-1369, 696-2851 or 554-3996.

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(PROVIDE SAME INFORMATION AS ABOVE FOR EACH ADDITIONAL INVENTOR)

## 2. Title of Invention:

*A Proxy-Assisted On-Line Predictive Prefetching Method*3. Stage of development, i.e. % complete, and relation of technology to the following product/process:  
20% complete

## 4. (a) Has a description of your invention been, or will it shortly be, published outside Intel:

NO: X YES: \_\_\_\_\_ DATE WAS OR WILL BE PUBLISHED:

If YES, was the manuscript submitted for pre-publication approval? YES: NO:

## (b) Has your invention been used/sold or planned to be used/sold by Intel or others?

NO: YES: X DATE WAS OR WILL BE SOLD:

## 5. If invention conceived, or constructed during performance of a government or third party contract, please check here and give the contract name and number

## 6. Please attach a page to this form, DATED AND SIGNED BY ONE INVENTOR (PREPARER), to provide an abstract of your invention, and include the following information in your abstract:

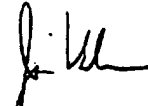
- (a) State general purpose(s) of your invention;
- (b) Describe advantage(s) of your invention over what is done now;
- (c) Describe essential element(s) or key to your invention; and

(d) Value of your invention to Intel (how will it be used?).

**HAVE YOUR SUPERVISOR READ, DATE AND SIGN COMPLETED FORM**

DATE:

SUPERVISOR:



BY THIS SIGNING, I (SUPERVISOR) ACKNOWLEDGE THAT I HAVE READ AND UNDERSTAND THIS DISCLOSURE, AND RECOMMEND THAT THE HONORARIUM BE PAID.

# **A Proxy-Assisted On-Line Predictive Prefetching Method**

Jin Jing  
Mike Tso

## ***General Purpose***

This invention disclosure describes a very effective on-line prefetching with the assistance of local and remote proxies. The proxy-assisted on-line prefetching mechanism improves user perceived browsing latency by automatically prefetching the pages that are likely to be accessed next during the connection "idle" time. A salient advantage of this proposed method is that the prefetching does not impose heavy access and computation load on Web servers or proxy servers while getting these pages fetched.

## ***Advantages over what is done now***

Various on-line prefetching scheme has recently been proposed to reduce the latency perceived by users by predicting and prefetching pages that are likely to be requested next, while the user is browsing through the currently displayed page [1]. The proposed scheme in [1] runs a predication algorithm at the server side to compute the probability or likelihood that a particular Web page will be accessed next and convey this information to the client. The client program then decides whether or not to actually prefetch the page. Recently two commercial products offer on-line prefetching feature: Peak Net.Jet from Peak Technologies Inc [<http://www.peak-media.com/>] and Blaze from Datatytics, Inc.. Net.Jet does not relay on server computation and information to make prefetching decisions. Instead the client Java code does it. Blaze, however, implements a server side program to assist the prefetching.

There are two problems with these proposed or existed solutions. First, the server side program imposes extra computation load on already overloaded Web servers. In addition, technologies like Blaze requires making changes on all the deployed web servers (in the millions) in order to work. Second, the pure client-side prefetching (e.g., Net.Jet) typically generate a lot of network traffic and jam Web servers with many useless requests.

The method described in this invention offers a very efficient solution to perform the on-line prefetching with the assistance of remote cache proxy server. A salient advantage of the described method is that neither proxy server nor the Web server needs to do any additional work for page request probabilities, nor will they see any increased network load. Instead, the cache proxy server simply makes request predications based on the proxy cache status. That is, if a prefetching candidate page is in the proxy cache, then the page will be the page that is likely to be accessed next. The simple predication based on the cache status is very logical and effective because proxy cache policy attempts to keep the pages that are popular to the majority of clients in the cache. In addition, unlike Blaze, there is no need to update software on the millions of existing web servers since proxies are already supported by all browsers and servers. To our best knowledge, no similar method that uses proxy cache status to make the prefetching predications has been proposed or implemented.

## ***Value of invention to Intel:***

This method could be implemented in the Scappoose proxy server. Scappoose is a new ICG product/business unit under development. We expect to begin customer visits by 1/27 and start beta-tests at customer sites as early as 2/15. We expect the 1.0 product to be shipped by 4/15/97, with 2 follow on products within six months. We expect Scappoose technology to attract competition very rapidly. Adequate patent protection is a critical part of our business plan.

## ***Approach summary***

The proposed method consists of three algorithms: (1) client prefetching generation, (2) (remote) proxy request predication, and (3) preemptive prefetching transmission. A proxy is installed on the user's machine, hereafter referred to as the "local proxy." The local proxy works in concert with a "remote proxy," which is deployed in the network. The remote proxy typically has a high speed connection (eg. T1 or T3) to the internet on one end, and on the other end it is connected to one or many clients on slower connections such as dialup. Both local and remote proxies advantageously include caching.

The local proxy runs the prefetching generation algorithm to produce a list of HTML URLs that are linked in the requested page (which is parsed first), prefetch these HTML URLs in the list, parse them to get image URLs, and prefetching these image URLs. The algorithm involves two rounds of requests to prefetch the next browser page (which include a HTML URL and in-line image URLs). An alternative is for proxy cache to make an entry link to each in-line cached image in the HTML entry so that the client proxy does not need to parse the HTML page for in-line image URLs. The price is, however, that the remote proxy cache has to book-keep the in-line image URLs in the HTML entry (an extra store requirement). The remote proxy cache can build the links based on request IP address information to decide which image URLs belong to a HTML page.

The remote proxy request predication works as follows: after the remote proxy receives a prefetching URL (the request is marked differently from user requested URLs, e.g. from a user clicking on a link), it checks if the URL is in the cache. If yes, the URL is fed to the client. Otherwise, it simply sends a "not found" message to the client.

The preemptive prefetching transmission is another key algorithm in the method. The algorithm is basically able to distinguish the prefetching transmissions from the regular browser request transmissions. Both the local and remote proxy maintains the connection property such that the prefetching transmissions can be suspended or stopped very quickly once a browser request transmission is connected between the local and remote proxies (this is why it is called preemptive prefetching transmission algorithm). Once the prefetching transmission is stopped, the connection will be closed too. This is because the local proxy will run a new execution of the client prefetching generation algorithm for the new requested browser page and establish another preemptive prefetching connection. If the client gets responses for all prefetching URLs (miss or hit at the remote proxy cache) before any browser request is generated, the preemptive prefetching connection is normally closed. To make a quick suspension (and close) of the preemptive connection from application layer (i.e., the proxy program), the transmission packages at two proxy ends (at the application layer) should be set to a relatively small size (e.g., 512 or 1024 bytes). Or a special escape character can be used in the stream, so the transmission can terminate at any time. Generally, the preemptive prefetching transmission should not coexist with the browser request transmission. Otherwise, the regular browser requests will be slowed down.

Another way to implement the preemptive transmission is to use prioritized socket multiplexing over the same link. At the link layer where packets are transmitted, a queue is used for each open socket. The rule is: sockets open due to a user action always gets higher priority, and all other lower priority socket traffic, including prefetches, are suspended (but not necessarily terminated) until the line is free again. The prefetching program on the client will make sure that the sockets it opens are somehow marked as "special" (this can be done by modifying the socket implementation or using ioctl), and the prefetching program has to decide when to terminate any open sockets.

## ***References:***

[1] Venkata Padmanabhan and Jeffrey C. Mogul, "Using Predictive Prefetching to Improve World Wide Web Latency", in ACM SIGCOMM Computer Communication Review, 1996, pp.22-36.

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# Intel Press Release

## New Intel Technology Speeds Delivery of Web Pages

### Market Trials of New Service to Begin in October

HILLSBORO, Ore., Sept. 25, 1997 – Intel today introduced new technology that speeds the delivery of Internet Web pages to users. The new technology is easy to use because users do not have to add software or hardware to their PCs. Several Internet providers plan to conduct market trials of the new Intel Quick Web Technology during the month of October.

Internet Service Providers NETCOM and Sprint, along with Digital Distribution company GlobalCenter, will market trials of the beta version of the new Intel Quick Web Technology in October. An estimated 1200 customers are expected to participate in the market trials. Customer reaction will validate the software design and help the providers determine how they will offer the technology to their customers. This new technology could deliver a new wave of premium service offerings by the Internet providers.

"Intel's new Quick Web Technology solves a real problem for Internet users – faster access to Web pages," said Frank Gill, Intel executive vice president and general manager, Internet and Communications Group. "This technology comes from Intel's extensive laboratory work in media content and data compression, allowing us to deliver the best experience for the Internet-connected PC user."

Intel Quick Web Technology is software designed to run on the Internet providers' servers and on servers at critical junctions on the World Wide Web, such as Network Access Points (NAP). This technology could also be deployed to benefit corporate intranets and international Internet gateways.

#### Technology Techniques

Intel Quick Web Technology uses several techniques to speed up the



print

email

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downloading of Internet graphic images. The software analyzes Web pages, searching for graphic images and compressing them by removing unnecessary data bits. The compressed Web page is received significantly faster because there is less data to download.

Intel Quick Web Technology further reduces download wait time through caching technology. A user's first request for a Web page is stored on the Internet provider's server. Subsequent visits to the same Web page are delivered quickly from this stored data.

Intel's new technology also includes a "Web-O-Meter" to indicate how much speed is gained using Intel Quick Web Technology. For graphically rich Web pages, preliminary lab tests indicate that most users will see Web pages in half the time. A key goal of the market trial is to verify these speed increases with real end users and Internet providers.

"The new Intel Quick Web Technology falls in line with our philosophy to maximize the Internet, bringing high-performance content to the world," said Jonathan Heiliger, chief technology officer at GlobalCenter. "We expect these initial trials to be so successful in increasing access to content that we will implement Intel Quick Web Technology in our geographically dispersed Media Distribution Centers. These centers are the cornerstone of our digital distribution architecture, designed to alleviate the over-burdened public exchanges and push content closer to the periphery of the networks onto the desktops of users more efficiently."

"NETCOM's strategy is to increase our customers' productivity while on the Internet," said Mike Kallet, NETCOM's senior vice president, products and services. "With the new Intel Quick Web Technology, we expect our small business and individual professional customers to see a dramatic increase in download speeds, making their time on the Web more efficient."

"Our customers need fast, simple, reliable Internet access and don't want to wait in line on the Web," said Jim Dodd, vice president, Sprint Internet Access Services. "Working with Intel to deliver Intel Quick Web Technology will help us provide exactly that."

Other industry participants also expressed support for the new Intel Quick Web Technology. "As a large Internetwork operator servicing nearly a million Web interactions per day, we've been waiting for someone to develop a technology that would increase the Web user experience without disrupting the customers' current computing



environment. We believe the Intel Quick Web Technology brings that technology to the market," said Antonio Salerno, CEO, ConXioN Corp. "We know that Intel has taken many measures to make sure that this product is well-architected and highly available. We believe that the customer will have a lot of benefit from this, and are looking forward to being a part of this solution."

Intel Quick Web Technology works with PCs equipped with the leading Internet browsers, including Microsoft Explorer\* 3.0 and above, Netscape Navigator\* 3.0 and above, and Netscape Communicator\* 4.0 and above.

Intel, the world's largest chip maker, is also a leading manufacturer of computer, networking and communications products. Additional information about Intel is available at [www.intel.com/pressroom](http://www.intel.com/pressroom).

\* Other names and brands may be claimed as the property of others.

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